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Total column water vapour (TCWV) in the visible "blue" spectral range: Methodology and first comparisons between GOME-2, OMI and TROPOMI

Christian Borger, Steffen Beirle, Thomas Wagner, Steffen Dörner, and Yang Wang
Max Planck Institute for Chemistry, Mainz, Germany (christian.borger@mpic.de)

Atmospheric water plays a key role for the atmospheric energy balance and temperature distribution via radiative effects (clouds and vapour) and latent heat transport. Hence the distribution and transport of water vapour is closely linked to atmospheric dynamics on all scales. In this context, global monitoring of the water vapour distribution is essential for numerical weather prediction and climate modelling.
Total column water vapour (TCWV) can be retrieved using Differential Optical Absorption Spectroscopy (DOAS) analysis in the visible "red" spectral range (620-670nm) as implemented in the GOME Data Processor GDP. However, this method has some limitations: several post-corrections e.g. due to non-linear effects have to be applied and the low ocean surface albedo leads to low sensitivity for near-surface layers. In addition many satellite sensors do not cover the red spectral range, e.g. TROPOMI on board ESA's Sentinel 5 Precursor satellite.
Here, we apply a new approach using the spectral absorption structures of H_2O in the "blue" spectral range (430-450nm). This approach has the advantage that nonlinear effects are negligible. Also this spectral window shows a higher sensitivity for near-surface layers over ocean and in general a smoother spatial distribution of the surface albedo compared to the red spectral range.
The retrieval is built on a linear least-squares fit and performed on a single spectral window, which enables a fast and robust processing of large data sets. In the retrieval spectral absorption by NO_2, O_3, O_4 and the Ring effect are considered in addition to H_2O. Furthermore, changes of the instrument spectral resolution function (ISRF) along the satellite's orbit can be accounted for using a linearized treatment of ISRF parameters as pseudo-absorbers. We will use this new algorithm for retrieving TCWV from TROPOMI spectra and compare these results with TCWVs retrieved from spectra of the OMI instrument on board NASA's Aura satellite and the GOME-2 instrument on board EUMETSAT's MetOp satellite.